CLAIMS

1. Method for cutting and removing underwater pipelines, comprising the following steps:

a) determining the position of the underwater pipeline (40) to be removed;

b) positioning, on the said line, guiding means (2) for positioning cutting means (4) and means (3) for recovering the cut pipe sections, said guiding means (2) being able to be repositioned along said line (40) and being stably connected to a boat (10) intended to collect the recovered sections;

c) guided positioning of the cutting means (4) and guided positioning of the recovery means (3);

d) cutting of the pipe section of predetermined length;

e) removal of said section by means of said recovery means (3);

f) transfer of the pipe section recovered by said recovery means to said boat (10);

g) repositioning of the guiding means (2) along the remaining line portion to be removed and repetition of the preceding steps c) to f) until the underwater pipeline (40) has been completely removed.

2. Apparatus for implementing the method for cutting and removing underwater pipelines according to Claim 1, comprising: means (4) for cutting said underwater pipelines (40), means (3) for recovering the cut sections (41) of said lines (40), guiding means (2) for positioning said cutting means (4) and recovery means (3), means (1) for suspending said guiding means (2), cutting means (4) and recovery means (3), and means (5) for transferring the recovered pipe sections (41) to the loading compartment of a boat (10), said means being located on a suitable support comprising a plate (6) arranged on the deck of said boat (10) opposite an opening (12) formed in the stern wall (11) thereof.

3. Apparatus according to Claim 2, in which said suspension means comprise a gantry (1) comprising two uprights (201) and a cross member (101, 301) to which the means (501, 506, 701, 706) for lowering and hoisting on-board said boat said guiding means (2), said cutting means (4) and said recovery means (3) are connected, said

gantry being arranged on said support plate (6) along the external edge directed towards said opening (12) formed in the stern wall (11).

4. Apparatus according to Claim 3, in which said uprights (201) of said gantry (1) are pivotably hinged (221, 306) with said support plate and provided with actuating means (106) which allow positioning of said gantry (1) in a substantially cantilever manner with respect to the stern wall (11) of said boat (10).

5. Apparatus according to Claim 3, in which said gantry (1), in the vicinity of the cross member (101), has connected thereto in cantilever fashion, by means of the arms (311), a beam (301) which is parallel to and has substantially the same length as the cross member (101).

6. Apparatus according to Claim 5, in which the deflection pulleys (501, 701) for the cables (826, 726) for suspension of the guiding means (2), recovery means (3) and cutting means (4) are arranged on the said cross member (101) and on the said beam (301).

7. Apparatus according to Claim 2, in which said guiding means comprise a guide unit (2) comprising: a support base (302) provided with means (402) for gripping said underwater pipeline (40), means (502) for moving said base (302) along said line (40), and a head-piece (202) mounted on a shaft (602) rotating on said base (302), said head-piece being provided thereon with means (242) for deflecting the cable (726) for connection with said suspension means (1), a floating body (222) and means (102) for detecting the position of said underwater line (40).

8. Apparatus according to Claim 7, in which said detecting means comprise at least one videocamera (122) and a sonar (112).

9. Apparatus according to Claim 8, in which said head-piece is furthermore provided thereon with a compass (252) arranged in the visual field of the videocamera (122).

10. Apparatus according to Claim 7, in which said shaft (602) is located on a carriage (612) movable in the direction of the length of said support base (302) so as to position said head-piece (202) at one of the two ends of said base (302).

11. Apparatus according to Claim 7, in which said support base (302) is provided, along its perimetral edges, with a plurality of nozzles (312) oriented perpendicularly with respect to the plane of travel of the cable (726) for suspending said guide unit (2) and able to eject pressurised fluid supplied by suitable means (322).

12. Apparatus according to Claim 7, in which said gripping means comprise jaws (402) provided with suitable actuating means (702, 712) arranged in said support base (302).

13. Apparatus according to Claim 7, in which said movement means comprise elements suitable for displacement such as wheels or belts (502) arranged along the sides of said support base (302) with a mutual inclination preferably of 90.

14. Apparatus according to Claim 2, in which said recovery means comprise a recovery unit (3) comprising gripping means (103) provided with a substantially rectangular box-shaped body (113), said box-shaped body (113) being connected to an upper frame (603) in which the means (633) for deflecting the cable (826) connected to said suspension means by means of the tie-rods (433, 513) are arranged.

15. Apparatus according to Claim 14, said box-shaped body (113) having arranged at one end a beam (503) stably connected to said body (113) at the ends of which two of the said tie-rods (513) are connected, and there being arranged longitudinally with respect to said body (113) a guide (303) in which a slider (413) is movable, said slider being associated with a trapezium (403) perpendicular to said guide (303) at the ends of which two more of the said tie-rods (433) are connected.

16. Apparatus according to Claim 14, in which said upper frame is provided with two cantilever arms (203) arranged perpendicular to the plane of travel of the cable (826) for suspension of the recovery unit (3), provided with retraction means (213, 223) and provided at their free end (253) with means (233, 243) for engagement with said guide means (2), which are releasable.

17. Apparatus according to Claim 2, in which said cutting means comprise a cutting unit (4) preferably comprising an endlessly wound diamond-coated cable (804) deflected around a plurality of pulleys (704, 604, 504), at least one of which

(504) is motor-driven and which are arranged so as to define a cutting plane perpendicular to the said underwater pipeline (40), said pulleys (704, 604, 504) being connected to a plate mounted slidably on at least one guide (204) and associated with actuating means (404, 414) for moving said plate (104) towards and away from said underwater line (40).

18. Apparatus according to Claim 17, in which said cutting unit (4) is mounted integrally with said recovery unit (3).

19. Apparatus according to Claim 2, in which said means for transferring the recovered pipe sections (41) comprise a pipe-guiding arm (5) hinged with the external edge of the support plate (6) directed towards the opening (12) in the stern wall (11) of the boat (10) and provided with actuating means (405, 415) for moving it from a position substantially perpendicular to the deck (13) of the boat (10) to a substantially parallel position and provided with means (305) for gripping the recovered pipe section (41) and means (225) for slidably guiding said section (41).